Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Two Year Degree Program in Botany

(Faculty of Science & Technology)

CBCS Syllabus

M.Sc. (Botany) Part-I Semester -II

For Department of Botany

Tuljaram Chaturchand College, Baramati

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2023-2024

Title of the Programme: M.Sc. (Botany)

Preamble

AES's Tuljaram Chaturchand College of Arts, Science and Commerce (Autonomous) has made the decision to change the syllabi of across various faculties from June, 2023 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students. By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Botany and related subjects, the Board of Studies in Botany at Tuljaram Chaturchand College of Arts, Science and Commerce (Autonomous), Baramati - Pune, has developed the curriculum for the first semester of F.Y. B.Sc. Botany which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and the Circular issued by SPPU, Pune on 31st May 2023.

A Botany Post Graduates degree equips students with the knowledge and skills necessary for a diverse range of fulfilling career paths. Post Graduates in Botany find opportunities in various fields, including urban planning, teaching, environmental science, all plant sciences, Bioinformatics, Genetic Engineering, Biostatistics, Plant Biotechnology,

Database analysis, Organic farming, nursery management, entrepreneurship mushroom cultivation, Plant physiology, Bryology, Taxonomy, Ethnobotany, plant tissue culture method and many other domains. Throughout their Two-year degree program, students explore the significance of plant in life of each and every living organism on Earth. They learn tool, techniques, process which is required to set up agencies including pickles, jam, and jelly medicinal plant, fruit processing, vegetable processing, organic product, organic fertilizer and pesticides producing industries also the can earn the knowledge to produce natural remedies for varies diseases. They became expert in discovery and development of many new therapeutic compounds which can be used in pharmaceutical herbal cosmetics and other cosmetic based industries.

Overall, revising the Botany syllabi in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

M.Sc. Botany

Program Outcomes (Pos) for M. Sc. Program

PO1	**Disciplinary Knowledge:** Demonstrate comprehensive knowledge of the discipline that forms a part of a postgraduate programme. Execute strong theoretical and practical understanding generated from the specific programme in the area of work.
PO2	**Critical Thinking and Problem solving:** Exhibit the skill of critical thinking and understand scientific texts and place scientific statements and themes in contexts and also evaluate them in terms of generic conventions. Identify the problem by observing the situation closely, take actions and apply lateral thinking and analytical skills to design the solutions.
PO3	**Social competence:** Exhibit thoughts and ideas effectively in writing and orally; communicate with others using appropriate media, build effective interactive and presenting skills to meet global competencies. Elicit views of others, present complex information in a clear and concise way and help reach conclusions in group settings.
PO4	**Research-related skills and Scientific temper :** Infer scientific literature, build a sense of enquiry and able to formulate, test, analyse, interpret and establish hypothesis and research questions; and to identify and consult relevant sources to find answers. Plan and write a research paper/project while emphasizing on academics and research ethics, scientific conduct and creating awareness about intellectual property rights and issues of plagiarism.
PO5	**Trans-disciplinary knowledge:** Create new conceptual, theoretical and methodological understanding that integrates and transcends beyond discipline-specific approaches to address a common problem.
PO6	**Personal and professional competence:** Perform independently and also collaboratively as a part of a team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	**Effective Citizenship and Ethics:** Demonstrate empathetic social concern and equity centred national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	**Environment and Sustainability:** Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO9	**Self-directed and Life-long learning:** Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

Anekant Education Society's
Tuljaram Chaturchand College, Baramati
(Autonomous)
Board of Studies (BOS) in Botany

Sr. No.	Name	Designation
1.	Prof. Dr. Bhagwan Mali	Chairman
2.	Prof. Dr. Mahadev Kanade	Member
3.	Prof. Dr. Ajit Telave	Member
4.	Dr. Rupali Chitale	Member
5.	Dr. Madhuri Patil	Member
6.	Mr. Sauraj N. Torane	Member
7.	Ms. Ashwini B. Dudhal	Member
8.	Mr. Prasad J. Bankar	Member
9.	Mr. Sourabh R. Chandankar	Member
10.	Prof. Dr. B. M. Gaykar	Expert from SPPU, Pune
11.	Prof. D. K. Gaikwad	Expert from other university
12.	Dr. Jay Chavan	Expert from other university
13.	Dr. S. Gurumurthy	Expert from allied area
14.	Mr. Gore Nitin Anil	Meritorious Student
15.	Ms. Ligade Komal Sambhaji	Meritorious Student
16.	Mr. Zodage Ram Sanjay	Meritorious Student
17.	Ms. Gargade Rutuja Hanumant	Meritorious Student

Structure and Credit Distribution of PG Degree Programme
Illustrative Credit Distribution structure for Two Years/One Year P.G. (M.Sc.- Botany)

<table>
<tr><th rowspan="2">Year (2 Year PG)</th><th rowspan="2">Level</th><th rowspan="2">Sem. (2 Yr.)</th><th colspan="2">Major</th><th rowspan="2">Research Methodology (RM)</th><th rowspan="2">OJT /FP</th><th rowspan="2">RP</th><th rowspan="2">Cum. Cr.</th><th rowspan="2">Degree</th></tr>
<tr><th>Mandatory</th><th>Electives</th></tr>
<tr><td rowspan="5">I</td><td rowspan="5">6.0</td><td rowspan="4">Sem-I</td><td>BOT -501-MJM: Plant Systematics-I (Credit 04)</td><td rowspan="4">BOT -511-MJE(A) :Genetics and Plant breeding (Credit 04)
OR
BOT -511-MJE(B) : Advanced Botanical Techniques. (Credit 04)</td><td rowspan="4">BOT-521-RM: Research Methodology (Credit 04)</td><td rowspan="4">--</td><td rowspan="4">--</td><td rowspan="4">20</td><td rowspan="9">PG Diploma (after 3 Year Degree)</td></tr>
<tr><td>BOT -502-MJM: Cell Biology and cell Signalling (Credit 04)</td></tr>
<tr><td>BOT -503-MJM Botany Laboratory-I (Credit 02)</td></tr>
<tr><td>BOT -504 -MJM Botany Laboratory-II (Credit 02)</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td rowspan="4">Sem- II</td><td>BOT -551-MJM: Plant Systematics II (Credit 04)</td><td rowspan="4">BOT -561-MJE (A): Molecular Biology and Genetic Engineering (Credit 04)
BOT -561-MJE(B): Plant Ecology and Biodiversity (Credit 04)</td><td rowspan="4">--</td><td rowspan="4">BOT 581-OJT/ FP (Credit 04)</td><td rowspan="4">--</td><td rowspan="4">20</td></tr>
<tr><td>BOT -552-MJM: Plant physiology and Biochemistry (Credit 04)</td></tr>
<tr><td>BOT -553-MJM: Botany Laboratory-I (Credit 02)</td></tr>
<tr><td>BOT -554-MJM Botany Laboratory-II (Credit 02)</td></tr>
<tr><td colspan="3">Cum. Cr. For PG Diploma</td><td>24</td><td>8</td><td>4</td><td>4</td><td>--</td><td>40</td></tr>
</table>

Abbreviations: (1) OJT: On Job Training: Internship/Apprenticeship; (2) FP: Field Projects; (3) RM: Research Methodology (4) RP: Research Projects (5) Cum.: Cumulative Credits

Course Code: BOT-501-MJM: BOT: Botany, 50: First Year P. G., 1: First Semester, First Paper, MJM: Major Mandatory Theory, MJE: Major Elective Theory

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
Credit Distribution Structure for M. Sc. Part: I (Botany)
(CBCS as per NEP 2020)
WEF: June 2023

Sem.	Course Type	Course Code	Course Title	Theory/ Practical	No. of Credits
I	Major (Mandatory)	BOT -501-MJM	Plant Systematics-I	Theory	4
	Major (Mandatory)	BOT -502-MJM	Cell Biology and Cell signaling	Theory	4
	Major (Mandatory)	BOT -503-MJM	Botany Laboratory-I	Practical	2
	Major (Mandatory)	BOT -504-MJM	Botany laboratory –II	Practical	2
	Major (Elective)	BOT -511-MJE(A)	Genetics and Plant breeding	Theory	4
		BOT -511-MJE(B)	Advanced Botanical Techniques	Theory	
	Research Methodology (RM)	BOT -521-RM	Research Methodology	Theory	4
	Total Credits Sem. I				**20**
II	Major (Mandatory)	BOT -551-MJM	Plant Systematics II	Theory	4
	Major (Mandatory)	BOT -552-MJM	Plant physiology and Biochemistry	Theory	4
	Major (Mandatory)	BOT -553-MJM	Botany laboratory -I	Practical	2
	Major (Mandatory)	BOT -554-MJM	Botany Laboratory –II	Practical	2
	Major (Elective)	BOT -561-MJE(A)	Molecular Biology and Genetic Engineering	Theory	4
		BOT -561-MJE(B)	Plant Ecology and Biodiversity	Theory	4
	On Job Training (OJT)/Field Project (FP)	BOT -581- OJT/FP	On Job Training Field Project	Training /Project	4
	Total Credits Sem. II				**20**
	Cumulative credits Sem I and II				**40**

CBCS SYLLABUS as per NEP 2020 For M. Sc. I Botany
(w. e. from June, 2023)

Name of the Programme	: M.Sc. Botany
Program Code	: PSBOT
Class	: M.Sc. – I
Semester	: II
Course Type	: Major Mandatory Theory
Course Code	: **BOT -551-MJM**
Course Title	: Plant Systematics II
No. of Credits	: 04
No. of Teaching Hours	: 60

A) Course Objectives:

1. To identify and classify taxonomy of pteridophytes and gymnosperms.
2. To understand the evolutionary relationships.
3. To investigate the ecological roles and adaptability.
4. To examine the fossil record of pteridophytes and gymnosperms.
5. To conservation of vulnerable pteridophyte and gymnosperm species.
6. To understand their adaptability and potential applications in biotechnology.
7. Explore the medicinal and ethnobotanical uses.

B) Course Outcomes:

By the end of course students will be able to

CO1. Know taxonomical gives accurate identification and classification of these plant groups.
CO2. Examine the evolutionary history and identify common ancestors.
CO3. Understand their ecological niche and potential implications for biodiversity.
CO4. Know documentation of the fossil record and past environmental conditions.
CO5. Understand data use for conservation and strategies to protect these plants from extinction.
CO6. Expert in identification of genes or traits with potential biotechnological significance.
CO7. Discover new pharmaceutical compounds to develop medicines.

Unit: 1 **(15 L)**

1.1 Pteridophytes: Distinguishing characters, origin of Pteridophytes – Algal origin, Bryophyte origin; Apospory, Apogamy, Parthenogenesis, Telome theory and Stelar evolution. **6L**

1.2 Classification of Pteridophytes as per Sporne System (1975), Indian Pteridology, Heterospory and seed habit and Economic importance of Pteridophytes. **4L**

1.3 Fossil Pteridophytes: Psilopsida: *Rhynia*, Lycopsida: *Lepidodendron, Lepidophyllum* and *Lepidostrobus,* Sphenopsida: *Calamites*. **5L**

Unit: 2 **(15L)**

2.1 Psilopsida: Distribution, distinguishing characters, morphology and anatomy of sporophyte and gametophyte of *Psilotum.* **1L**

2.2 Lycopsida: Distribution, distinguishing characters, affinities, morphology and anatomy of sporophyte and gametophyte of Lycopodiales, Isoetales and their life cycle pattern. **4L**

2.3 Sphenopsida: Distribution, distinguishing characters, morphology and anatomy of sporophyte and gametophyte, Life cycle pattern of Equisetales. **2L**

2.4 Pteropsida/Filicophyta: Distribution, distinguishing characters, morphology and anatomy of sporophyte and gametophyte of order: Ophioglossales, Marattiales, Osmundales, Filicales and Marsileales. **8L**

Unit: 3 **(15 L)**

3.1 Gymnosperm: Distinguishing characters, distribution, affinities of gymnospermswith pteridophytes and angiosperms and economic importance of gymnosperms. **4L**

3.2 Classification of gymnosperm as per Sahni (1920), Chamberlain (1934), Sporne (1965). **3L**

3.3 Pteridospermales w.r.t general characters- *Lyngiopteris*, *Neuropteris*, *Glossopteris* and *Caytonia.* **4L**

3.4 Cycadeoidales: General characters, structure of *Cycadeoidea*; Pentoxylales : General characters, *Pentoxylon*, structure of secondary wood, maleand female strobili, and contribution of Birbal Sahni; Cordaitales : General characters, structure of *Cordaites*. **4L**

Unit : 4 **(15 L)**

4.1 General characters, affinities, morphology of sporophytes and gametophytes of living gymnosperm orders (any one example of each) :

Cycadales , Ginkgoales **5L**

Coniferales, Gnetales **5L**

Ephedrales, Welwitschiales **5L**

References:

1. Agashe S. N. (1995). Paleobotany. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Arnold A. C. (2005). An Introduction to Paleobotany. Agrobios (India). Jodhpur.
3. Eames E.J. (1983). Morphology of Vascular Plants. Standard University Press.
4. Sharma O.P. (1990). Textbook of Pteridophyta. MacMillan India Ltd. Dehi.
5. Smith G.M. (1955). Cryptogamic Botany Vol II. McGraw Hill.
6. Sporne K.R. (1986). The morphology of Pteridophytes. Hutchinson University Library, London.
7. Stewart W.N. and Rothwell G.W. (2005). Paleobotany and the Evolution of

Plants. 2nd Edn. Cambridge University Press.
8. Vashista B. R., Sinha A.K., Kumar A. (2008). Botany for degree students – Pteridophyta, S.Chands Publication.
9. Vashishta P.C., A.R. Sinha, Anil Kumar. 2006. Gymnosperms. S. Chand.

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem II) **Subject**: Botany

Course: Plant Systematics II **Course Code**: BOT-551-MJM

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2		3							
CO 3		3							
CO 4			1			2			
CO 5		2		2				1	
CO 6				2				1	
CO 7					1		1	1	1

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Taxonomy gives accurate identification and classification of these plant groups.

CO2. Examine the evolutionary history and identify common ancestors.

CO3. Understanding their ecological niche and potential implications for biodiversity.

CO4. Documentation of the fossil record and past environmental conditions.

CO5. Data use for conservation and strategies to protect these plants from extinction.

CO6. Identification of genes or traits with potential biotechnological significance.

CO7. Discover new pharmaceutical compounds to develop medicines.

PO2: Critical Thinking and Problem Solving

CO2. Examine the evolutionary history and identify common ancestors.

CO3. Understanding their ecological niche and potential implications for biodiversity.

CO5. Data use for conservation and strategies to protect these plants from extinction.

PO 3: Social competence

CO1. Taxonomy gives accurate identification and classification of these plant groups.

PO 4: Research-related skills and Scientific temper

CO5. Data use for conservation and strategies to protect these plants from extinction.

CO6. Identification of genes or traits with potential biotechnological significance.

PO5: Trans-disciplinary Knowledge

CO7. Discover new pharmaceutical compounds to develop medicines.

PO6: Personal and Professional Competence

CO4. Documentation of the fossil record and past environmental conditions.

PO 7: Effective Citizenship and Ethics

CO7. Discover new pharmaceutical compounds to develop medicines.

PO 8: Environment and Sustainability

CO5. Data use for conservation and strategies to protect these plants from extinction.

CO6. Identification of genes or traits with potential biotechnological significance.

CO7. Discover new pharmaceutical compounds to develop medicines.

PO 9: Self-directed and Life-long Learning

CO7. Discover new pharmaceutical compounds to develop medicines.

Name of the Programme	**:** M.Sc. Botany
Program Code	**:** PSBOT
Class	**:** M.Sc. I
Semester	**:** II
Course Type	**:** Major Mandatory Theory
Course Code	**: BOT -552-MJM**
Course Title	**:** Plant Physiology and Biochemistry
No. of Credits	**:** 04
No. of Teaching Hours	**:** 60

A) Course objectives:

1. To give knowledge of physiobiochemical processes that occurs in plants.
2. To make aware about structure and role of biomolecules in plants.
3. It focuses on plant nutrients uptake and translocation, photosynthesis, respiration and nitrogen metabolism.
4. To study the plant stress response.
5. To give knowledge about Secondary metabolites.
6. To explore biochemical pathways in the plants.
7. To investigate plant hormones and growth regulators.

B) Course Outcomes:

By the end of course students will be able to

CO1. Development of expertise in plant physiology and biochemistry.
CO2.Understand physiological processes involved in growth and development of plants
CO3. Understanding of transpiration, photosynthesis and respiration, nutrient uptake.
CO4. Recognize response in stress like drought, salinity and pathogens.
CO5. Explore the synthesis and functions of secondary metabolites in plants.
CO6. Study the intricate biochemical pathways in plants.
CO7. Examine the role of plant hormones and growth regulators.

UNIT : 1 **(15 L)**

1.1 Photosynthesis : Photosynthetic pigments, absorption and transformation of radiant energy, Light Harvesting complexes, Kok curve, Kautsky curve, Organisation of photosynthetic ETS, photo inhibition O2 and H2 evolution, Calvin Cycle and its regulation RUBISCO activity, Photorespiration, CAM, C4 Pathway and its types. **8L**

1.2 Respiration: EMP pathway, TCA cycle, Pentose phosphate pathway, Organisation of mitochondrial ETS, Gluconeogenesis, reverse gluconeogenesis, High energy compounds: Synthesis and utilization, ATP synthesis, Cyanide resistance pathway and role of Alternate oxidase, Photorespiratory pathway, Significance of Photorespiration and dark respiration. **6L**

UNIT : 2 **(15L)**

2.1 Overview of Solute Transport : Uptake, Transport and translocation of water, ions, solutes

and macronutrients from soil through cells, across membranes, through xylem and phloem, transpiration, Translocation of photoassimilate, Transport in phloem, Source and Sink relationship, Diffusion, Osmosis, Uniport, Symport, Antiport channels. **5L**

2.2 Organic acid metabolism : Role and metabolism of oxalic acid, ascorbic acid and malic acid. **3L**

2.3 Stress Physiology : Response of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses. Mechanism of resistance to biotic stress and tolerance to abiotic stress. **3L**

2.4 Plant growth regulators : Biosynthesis and action mechanism of Auxins, Gibberellins (GA), Cytokinins Ethylene and Abscisic Acid. **4L**

UNIT : 3 **(15L)**

3.1 Energy Dynamics : Structure of atoms, molecules and chemical bonds, Principles of thermodynamics, free energy, Redox potentials, Dissociation and associations constants, Activation energy, Binding energy. **3L**

3.2 Principles of biophysical chemistry : Concept of pH, buffer, thermodynamics, colligative properties. Ions and electrical potentials – Nernst and Goldman equations. **3L**

3.3 Enzymology : Definition, classification and properties of enzymes, Isozymes, Factors affecting enzyme activity, Enzyme Kinetics, Michaels -Menton equation, Enzyme inhibition (Competitive, uncompetitive and non-competitive inhibition). **4L**

3.4 Amino acids and proteins : General classification of amino acids and proteins, Structure, synthesis and properties of amino acids, protein structure (Primary, secondary, tertiary and quaternary), Ramchandran plot. **5L**

UNIT- 4
(15L)

4.1 Nitrogen metabolism : Nitrate and ammonium assimilation, Nitrogen uptake, Nodulation (NOD) Factor, root nodulation and nitrogen fixation. **3L**

4.2 Secondary metabolites : General classification of Secondary metabolites Major pathways of synthesis of secondary metabolites - Phenolics (Lignins, tannins) Flavonoids, terpenoids (steroids), Alkaloids, pigments (Carotenoids, Anthocynins) **5L**

4.3 Carbohydrates metabolism : General classification, Synthesis and breakdown of carbohydrates (starch, glycogen, pectin, Glucose) **3L**

4.4 Lipid metabolism : General classification of Phospho, Spingo, Glyco lipid, Biosynthesis and breakdown(β -oxidation) of lipid. **4L**

References :

1. Buchanan B.B, Gruissem W. and Jones R.L (2015). Biochemistry and Molecular Biology of Plants. (Second edition) Wiley publisher.
2. Dennis D.T., Turpin, D.H. Lefebvre D.D. and Layzell D.B. (eds) (1997). Plan Metabolism (Second Edition) Longman, Essex, England.
3. Galstone A.W. (1989). Life processes in Plants. Scientific American Library, Springer Verlag, New York, USA..
4. Moore T.C. (1989). Biochemistry and Physiology of Plant Hormones *Springer* –Verlag, New York, USA.
5. Nobel P.S. (1999). Physiochemical and Environmental Plant Physiology (Second Edition) *Academic Press*, San Diego, USA.
6. Salibury F.B. and Ross C.W. (1992). Plant physiology (Fourth Edition) *Wadsworth Publishing Company*, California,USA.
7. Singhal G.S., Renger G., Sopory, S.K. Irrgang K.D and Govindjee (1999). Concept in Photobiology; Photosynthesis and Photomorphogenesis. *Narosa Publishing House*, New Delhi.
8. Taiz L. and Zeiger E. (2014). Plant Physiology and Development (6th Edition). Sinauer Associates is an imprint of Oxford University Press
9. Thomas B. and Vince-Prue D. (1997). Photoperiodism in Plants (Second Edition) *Academic Press*, San Diego, USA.

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem II) **Subject**: Botany

Course: Plant Physiology and Biochemistry **Course Code**: BOT-552-MJM

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1		1		1					
CO 2	3		1						
CO 3	3								
CO 4	3								
CO 5				2				1	
CO 6					1				1
CO 7						1	1		

Justification for the mapping

PO1: Disciplinary Knowledge

CO2.Understand physiological processes involved in growth and development of plantsCO3. Understanding of transpiration, photosynthesis and respiration, nutrient

uptake.

CO4. Recognize response in stress like drought, salinity and pathogens.

PO2: Critical Thinking and Problem Solving

CO1. Development of expertise in plant physiology and biochemistry.

PO 3: Social competence

CO2.Understand physiological processes involved in growth and development of plants.

PO 4: Research-related skills and Scientific temper

CO1. Development of expertise in plant physiology and biochemistry.

CO5. Explore the synthesis and functions of secondary metabolites in plants.

PO5: Trans-disciplinary Knowledge

CO6. Study the intricate biochemical pathways in plants.

PO6: Personal and Professional Competence

CO7. Examine the role of plant hormones and growth regulators.

PO 7: Effective Citizenship and Ethics

CO7. Examine the role of plant hormones and growth regulators.

PO 8: Environment and Sustainability

CO5. Explore the synthesis and functions of secondary metabolites in plants.

PO 9: Self-directed and Life-long Learning

CO6. Study the intricate biochemical pathways in plants.

Name of the Programme : M.Sc. Botany
Program Code : PSBOT
Class : M.Sc. I
Semester : II
Course Type : Major Mandatory Practical.
Course Code : BOT -553-MJM
Course Title : Botany Laboratory- I
No. of Credits : 02
No. of Teaching Hours : 60

A) Course Objectives:

1. To enable students to identify and classify different pteridophyte species.
2. To explore the reproductive structures of gymnosperms.
3. To facilitate a comparative analysis of the reproductive and vegetative structures
4. To analyze fossils to gain insights into ancient plant life.
5. To learn about the prehistoric ecosystems in which they thrived.
6. To analyse life cycles of pteridophytes and gymnosperms.
7. To discuss evolutionary significance.

B) Course Outcome:

By the end of course students will be able to

CO1. Accurately identify and classify pteridophyte specimens.
CO2. Comprehend the reproductive mechanisms of gymnosperms.
CO3. Gain a deeper understanding of the evolutionary relationships and adaptations.
CO4. Recognize fossil specimen importance in reconstructing ancient plant communities.
CO5. Infer information about past environments and ecosystems.
CO6. Describe and compare the life cycles and highlighting differences and similarities.
CO7. Know the evolution of land plants and their significance in Earth's history.

Practicals Based on Based on PSBOT:

1. Study of Psilopsida (Any one example). (1P)
2. Study of Lycopsida (Any one example). (1P)
3. Study of Sphenopsida (Any one example). (1P)
4. Study of Pteropsida (Any one example). (1P)
5. Study of fossil Pteridophytes (Any two example). (1P)
6. Study of external, internal, reproductive morphology of *Cycas.* (1P)
7. Study of external, internal, reproductive morphology of *Xamia.* (1P)
8. Study of external, internal, reproductive morphology of *Pinus.* (1P)
9. Study of external, internal and reproductive morphology of *Gnetum.* (1P)
10. Study of external, internal and reproductive morphology of *Thuja.* (1P)
11. Study of fossil specimens of gymnosperm from order Pteridospermales. (2P)
12. Study of fossil specimens of gymnosperm Cycadeoidales. (1P)

13. Study of fossil specimens of gymnosperm Pentoxylales. (1P)
14. Botanical excursion tour is compulsory to study Pteridophytes and Gymnosperms, submission of tour report. (1P)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem II) **Subject**: Botany

Course: Botany Laboratory - I **Course Code**: BOT-553-MJM

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3	3	1						1
CO 2	3								
CO 3	3								
CO 4		3		2			1		
CO 5					1	1		1	1
CO 6		3							
CO 7	3								

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Students will be able to accurately identify and classify pteridophyte specimens.CO2. Students will comprehend the reproductive mechanisms of gymnosperms.

CO3. Students will gain a deeper understanding of the evolutionary relationships andadaptations.

CO7. They will know the evolution of land plants and their significance in Earth's history.

PO2: Critical Thinking and Problem Solving

CO1. Students will be able to accurately identify and classify pteridophyte specimens.

CO4. They will recognize fossil specimen importance in reconstructing ancient plantcommunities.

CO6. Student will describe and compare the life cycles and highlighting differences andsimilarities.

PO 3: Social competence

CO1. Students will be able to accurately identify and classify pteridophyte specimens.

PO 4: Research-related skills and Scientific temper

CO4. They will recognize fossil specimen importance in reconstructing ancient plantcommunities.

PO5: Trans-disciplinary Knowledge

CO5. They will able to infer information about past environments and

ecosystems.

PO6: Personal and Professional Competence

CO5. They will able to infer information about past environments and ecosystems.

PO 7: Effective Citizenship and Ethics

CO4. They will recognize fossil specimen importance in reconstructing ancient plantcommunities.

PO 8: Environment and Sustainability

CO5. They will able to infer information about past environments and ecosystems.

PO 9: Self-directed and Life-long Learning

CO1. Students will be able to accurately identify and classify pteridophyte specimens.

CO5. They will able to infer information about past environments and ecosystems.

Name of the Programme	**:** M.Sc. Botany
Program Code	**:** PSBOT
Class	**:** M.Sc. I
Semester	**:** II
Course Type	**:** Major Mandatory Practical
Course Code	**: BOT -554-MJM**
Course Title	**:** Botany Laboratory II
No. of Credits	**:** 04
No. of Teaching Hours	**:** 60

A) Course objectives:

1. To provide hands- on experience in conducting experiments.
2. To give deep knowledge about physiological processes that govern plant growth.
3. To familiarize students with essential laboratory techniques and equipment used.
4. To prepare students for future research, careers in life sciences.
5. To develop the ability to design and execute controlled experiments in plant physiology.
6. To generate knowledge about various biomolecules present in plants.
7. To train skilled students in physiological and biochemical techniques.

B) Course Outcomes:

By the end of course students will be able to:

CO1. Conduct a variety of plant physiology and biochemistry experiments.
CO2. Understand plant response to abiotic and biotic factors.
CO3. Expertise in using and maintaining laboratory equipments.
CO4. Do research, careers in life sciences.
CO5. Got the ability to design and execute controlled experiments.
CO6 Get knowledge about various biomolecules present in plants.
CO7. Get expertise in physiological and biochemical techniques

Practicals Based on Based on PSBOT:

1. Preparation of solution of different concentrations, Buffers, Conductivity and pH Measurements. **(**1P)
2. Extraction and estimation of enzyme activity- Catalase/peroxidase. (1P)
3. Estimation of soluble proteins in germinating seeds by Lowry's method. (1P)
4. Isolation and estimation of chlorophylls / carotenoid or separation of pigment using column chromatography. (1P)
5. Estimation of ascorbic acid in ripe and unripe fruits. (1P)
6. Effect of salt stress on proline accumulation and its estimation. (1P)
7. Measure transpiration rates under different conditions such as humidity, temperature and light. (1P)
8. Visit to any research centre. (1P)
9. Study the effect of temperature on seedling growth. (1P)

10. Study of osmotic potential and plasmolysis in plant (Rhoeo). (1P)
11. Isolation and estimation of chlorophyll. (1P)
12. Analyze the lipid content in samples by thin layer chromatography. (1P)
13. Study of protein concentration determination by Bradford method or lowery method. (1P)
14. Study the effect of soil pH on nutrients uptake by plant. (1P)
15. Study the effect of plant growth hormones (auxin, gibberlin, ethylene, ABA) on plant growth. (1P)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem II) **Subject**: Botany

Course: Botany Laboratory - II **Course Code**: BOT-554-MJM

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3			3					
CO 2	3	1	1			1		1	
CO 3	3					1			
CO 4				1					1
CO 5				3					
CO 6	3								
CO 7			1	2					

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Expertise in conducting a variety of plant physiology and biochemistry experiments.

CO2. A deep understanding of plant response to abiotic and biotic factors.

CO3. Expertise in using and maintaining laborator equipments.

CO6. Students get knowledge about various biomolecules present in plants.

PO2: Critical Thinking and Problem Solving

CO2. A deep understanding of plant response to abiotic and biotic factors.

PO 3: Social competence

CO2. A deep understanding of plant response to abiotic and biotic factors.

CO7. Students trained in physiological and biochemical techniques

PO 4: Research-related skills and Scientific temper

CO1. Expertise in conducting a variety of plant physiology and biochemistry experiments.

CO4. Students will able to do research, careers in life

sciences.

CO5. Students will get the ability to design and execute controlled experiments.

CO7. Students trained in physiological and biochemical techniques

Name of the Programme	**:** M.Sc. Botany
Program Code	**:** PSBOT
Class	**:** M.Sc. - I
Semester	**:** II
Course Type	**:** Major Elective
Course Code	**: BOT -561-MJE (A)**
Course Title	: Molecular Biology and Genetic Engineering
No. of Credits	**:** 04
No. of Teaching Hours	**:** 60

A) Learning Objectives:

1. Understand the fundamentals of molecular biology.
2. Develop proficiency in recombinant DNA technology.
3. Explore the mechanisms of gene regulation.
4. Investigate the applications of genetic engineering in biotechnology.
5. Comprehend the ethical and societal implications of genetic engineering.
6. Master the tools and techniques for genetic sequencing and analysis.
7. Foster critical thinking and problem-solving skills in molecular biology.

B) Course Outcome:

By the end of course students will be able to

CO1. Explain the central dogma of molecular biology.
CO2. Perform techniques such as PCR, DNA cloning.
CO3. Analyze and interpret gene regulation networks.
CO4. Genetic engineering principles to areas such as the production of recombinant proteins and gene therapy.
CO5. Engage in informed discussions.
CO6. Analyze genetic data and predict gene functions.
CO7.Formulate and address research questions, design experiments and analyze data.

Unit: 1 **(15L)**

1.1 The structure and function of DNA **6L**

a. The importance of technological advances: the Hershey–Chase experiment.
b. A model for the structure of DNA: the DNA double helix.
c. Primary structure, secondary and tertiary structure of DNA, Alternative forms of DNA (A, B, C, D, Z).

1.2 Replication of DNA **4L**

a. Principle, Modes of replication (Conservative, semiconservative and dispersive).
b. Biochemical mechanism of DNA Replication – Enzymes involved in DNA replication

Fidelity of replication.

c. Bidirectional and Rolling circle replication.

1.3 DNA damage and repair **3L**

a. Types of DNA Damages, DNA repair mechanisms
b. Copying with DNA Damage without Repairing It.
c. Transposition – types of transposons

Unit: 2 **(15L)**

2.1 Structural organization of Gene **4L**

a. Organization and Structure of prokaryotic and eukaryotic genes Structure and role of promoters, enhancers and terminators, exons and introns.
b. Genetic code.

2.2 Transcription RNA synthesis **5L**

a. Different types of RNA (m-RNA, r-RNA and t-RNA)
b. Transcription apparatus.
c. RNA polymerases and their role.
d. Transcription in prokaryotes and eukaryotes- Initiation, elongation and termination.
e. RNA processing-RNA editing capping, methylation, polyadenation and splicing.

2.3 Translation protein synthesis **6L**

a. Translation in prokaryotes and eukaryotes (initiation, elongation and termination).
b. Controlling factors of translation.
c. Gene Regulation (Lac operon, trp operon).
d. Translational proof-reading, translational inhibitors, Post- translational modification of proteins.

Unit: 3 **(15L)**

3.1 Molecular gene cloning **6L**

a. Introduction, tools of recombinant DNA technology, Preparation of recombinant DNA.
b. DNA libraries: genomic library, chromosomal library, cDNA library.
c. Enzymes used in genetic engineering: Restriction enzymes.

3.2 Methods of expressing cloned genes **6L**

a. Plasmids: pUC, pBR etc., Phages: Lambda and T4 phages, Cosmids, BACs and YACs, Shuttle vectors.
b. Ti-plasmids and Ri- plasmids, Plant DNA viruses.

3.3 Identification of recombinants **3L**

a. PCR principle and applications.

b. DNA probes.
c. DNA sequencing methods.

Unit: 4 **(15L)**

4.1 Isolation of gene and gene libraries **3L**

a. Techniques of DNA isolation and methods of purification.
b. Preparation of cDNA, Genomic DNA library, cDNA libraries.

4.2 Plant Genetic Engineering **6L**

a. Gene Transfer Methods- direct and indirect gene transfer in plants.
b. *Agrobacterium* mediated Gene transfer methods.
c. Screening for transformants.
d. Transgenic plants-molecular approaches.

4.3 Application of genomics and proteomics **2L**

a. Concept of genomics and proteomics, Human genome project, objective of proteomics.
b. Methodologies of proteomics (2D gel electrophoresis).

4.4 Applicationof Genetic Engineering **4L**

a. Transgenic plants for drought, cold and disease resistance.
b. Lignin modification.

References:

1. Lewin B. (2000). Genes VII. Oxford University Press, New York.
2. Alberts, B., Bray, D Lewis, J., Raff, M., Roberts, K and Walter (1999). Molecular Biology of the Cell. Garland Publishing, Inc., New York.
3. Wolfe S. L. (1993) Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA.
4. Rost, T. *et al* (1998). Plant Biology. Wadsworth Publishing Company, California, USA.
5. Krishnamurthy, K.V. (2000). Methods in Cell Wall Cytochemistry. CRC Press, Boca Raton, Florida.
6. Buchanan B.B, Gruissm W. and Jones R.L (2000). Biochemistry and MolecularBiology of Plant. American Society of Plant Physiologist, Maryland, USA.
7. De D.N (2000). Plant Cell Vacuoles: An Introduction. CISRO Publication, Collingwood, Australia.

Name of the Programme	**:** M.Sc. Botany
Program Code	**:** PSBOT
Class	**:** M.Sc. - I
Semester	**:** II
Course Type	**:** Major Elective
Course Code	**: BOT -561-MJE (B)**
Course Title	: Plant Ecology and Biodiversity
No. of Credits	**:** 04
No. of Teaching Hours	**:** 60

A) Course objectives:

1. To create awareness about the plants and its environment.
2. To understand the need for conservation of species and the biodiversity.
3. To make aware about the rules and regulations for protection of biodiversity.
4. To learn techniques for habitat analysis and conservation planning.
5. To gain basic ecological ideas, such as the interactions between plants.
6. To understand the function of plants in ecosystems.
7. To evaluate human impact on habitat loss, invasive species.

B) Course outcomes:

By the end of course students will be able to

CO1. Appreciate the ethical, cross-cultural and historical context of environmental issues.
CO2. Identify plant vegetative.
CO3 Understand the concepts, types and functions of various ecosystems.
CO3. Understand the ecological concepts.
CO4. Identify plant species and communities in various ecosystems.
CO5. Recognize conservation of biodiversity.
CO6. Recognize and assess human impacts on plant biodiversity and ecosystems.
CO7. Develop strategies to protect and manage plant biodiversity.

UNIT : 1 **(15L)**

1.1 Basic Ecological Concept: Habitat ecology, synecology, autecology; Ecosystem concept; Structure and functions of biotic and abiotic components; Energy exchange-food chains and food webs, ecological pyramids. **6L**

1.2 Niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement. Plant relation with the environment. Plant interaction with the biotic and abiotic environment (Climatic, edaphic, Hydrological), Plant distribution with respect to topographic factors. **4L**

1.3 Conservation ecology: Principles of conservation, *En- situ* (Zoological and Botanical

Garden) and Ex-situ conservation, major approaches in management, role of WWF, IUCN, MAB, UNESCO, and UNEP in environmental education. Steps taken by T. C. College towards conservation of Biodiversity. **5L**

UNIT: 2 **(15L)**

2.1 Population Ecology : Characteristics of population, population growth curves, factors affecting population size, Life history strategies, r and k selection, C-S-R triangle, Concept of meta population, extinction events. **7L**

2.2 Community Ecology: Nature of communities; community structure and attributes; measurement of diversity, Diversity types -alpha, beta, gamma, ecotone and edge effect. **4L**

UNIT: 3 **(15L)**

3.1 Ecosystem Ecology: Ecosystem: Components and organization; energy flow in ecosystem; mineral cycling (C, N, and P cycle); Ecosystem productivity- primary, secondary, GPP, NPP, structure and functions of some of the ecosystems: terrestrial (forest, grassland, Desert) and aquatic (fresh water, marine, estuarine). **7L**

3.2 Ecological Succession: Plant succession: Autogenic and allogenic, mechanism and phases; pioneer, seral and climax communities, primary and secondary succession, Hydroseres, lithoseres, xeroseres and haloseres. **3L**

3.3 Applied Ecology: Environmental pollution its impact (Air, water, soil and noise), global environmental change; Environmental Impact Assessment, Concepts- Carbon sequestration, Global Climate Change, toxicology. **5L**

UNIT: 4 **(15L)**

4.1 Biodiversity: Concept, Scope and definitions, types of biodiversity-genetic diversity, species Diversity, ecosystem diversity. **2L**

4.2 Value and use of biodiversity: Ethical, aesthetic, food, fodder, ornamentals, medicinal, economical and socio- ecological approach etc. **2L**

4.3 Loss of biodiversity: Factors affecting diversity, natural verses anthropogenic, loss of biodiversity and its consequences on the human life. Factors affecting loss of genetic diversity, species diversity and ecosystem diversity. **4L**

4.4 Conservation of Biodiversity: Indian initiatives in biodiversity conservation- biodiversity act 2002, Biodiversity Rules 2004, National Biodiversity Strategy and Action Plan (NBSAP), Plant Varieties Protection and Farmer's Rights Act, 2001, National Biodiversity Authority (NBA) etc. Protected Area Network (PAN)- ecological sensitive zone; important protected areas of India, International program for biodiversity conservation, convention on biological

diversity (CBD), CITES, Kyoto Protocol, Ramsar Convention on Wetlands, **7L**

Reference:

1. Ambhast, R. S. (1998).A Text Book of Plant Ecology, 9th edition, Friend and Co.
2. Begon, M., Townsend, C. R., Harper, J. L. (2005). Ecology: From Individuals to Ecosystems, 4th edition, Wiley Black well..
3. Coleman, D. C., Crossley, D. A., Handrix, P. F. (2004). Fundamentals of Soil Ecology, 2nd edition, Elsevier academic press.
4. De, A. K. (1994).Environmental Chemistry, Wiley Eastern publication.
5. Gurevitch,J., Scheiner, S. M., Fox, G. A. (2006). The Ecology of Plants, Sinauer Associates.
6. Mukherjee, B. (1996).Environmental Biology, 1st edition, Tata Mc Graw Hill.
7. Mukherjee, B. (2000). Environmental Management: Basic and Applied Aspects of Management of Ecological Environmental System, 1st edition, Vikas Publication.
8. Odum E. P. (2007). Fundamentals of Ecology, 5th edition, Thomson Books.
9. Yadav, P. R. and Mishra, S. R. (2004). Environmental Biology, Discovery Publication, New Delhi.

Name of the Programme	**:** M.Sc. Botany
Program Code	**:** PSBOT
Class	**:** M.Sc. - I
Semester	**:** II
Course Type	**:** Field Project (FP)
Course Code	**: BOT-581- FP**
Course Title	: Field Project (FP)
No. of Credits	**:** 04
No. of Teaching Hours	**:** 60

A) Learning Objectives:

1. To give hands on training and practical skills to the students.
2. To provide the knowledge required for writing of review and case studies.
3. To give knowledge about review of literature.
4. To learn about results and discussion.
5. To learn about conclusion and references.
6. To impart the knowledge of writing thesis.
7. To impart the knowledge of power point presentation.

B) Course outcomes:

By the end of course students will be able to

CO1 Get hands on training and practical skills.
CO2 Write of review.
CO3 Review of literature.
CO4 Understand results and discussion.
CO5 Write of case studies.
CO6 Search review of literature.
CO7 Understand techniques of presentation.

No. of Credit: 4 Field Project **60L**

Projects will be allotted in third semester and students will submit project work having Introduction, review of literature, well defined material and methods, results and discussion, conclusions and references. The project should be presented at the end of second semester.

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem II) **Subject**: Botany

Course: Plant Systematics II **Course Code**: BOT-551-MJM

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2		3							
CO 3		3							
CO 4			1			2			
CO 5		2		2				1	
CO 6				2				1	
CO 7					1		1	1	1

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Taxonomy gives accurate identification and classification of these plant groups.

CO2. Examine the evolutionary history and identify common ancestors.

CO3. Understanding their ecological niche and potential implications for biodiversity.

CO4. Documentation of the fossil record and past environmental conditions.

CO5. Data use for conservation and strategies to protect these plants from extinction.

CO6. Identification of genes or traits with potential biotechnological significance.

CO7. Discover new pharmaceutical compounds to develop medicines.

PO2: Critical Thinking and Problem Solving

CO2. Examine the evolutionary history and identify common ancestors.

CO3. Understanding their ecological niche and potential implications for biodiversity.

CO5. Data use for conservation and strategies to protect these plants from extinction.

PO 3: Social competence

CO1. Taxonomy gives accurate identification and classification of these plant

groups.

PO 4: Research-related skills and Scientific temper

CO5. Data use for conservation and strategies to protect these plants from extinction.
CO6. Identification of genes or traits with potential biotechnological significance.

PO5: Trans-disciplinary Knowledge

CO7. Discover new pharmaceutical compounds to develop medicines.

PO6: Personal and Professional Competence

CO4. Documentation of the fossil record and past environmental conditions.

PO 7: Effective Citizenship and Ethics

CO7. Discover new pharmaceutical compounds to develop medicines.

PO 8: Environment and Sustainability

CO5. Data use for conservation and strategies to protect these plants from extinction.
CO6. Identification of genes or traits with potential biotechnological significance.
CO7. Discover new pharmaceutical compounds to develop medicines.

PO 9: Self-directed and Life-long Learning

CO7. Discover new pharmaceutical compounds to develop medicines.

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem II) **Subject**: Botany

Course: Plant Physiology and Biochemistry **Course Code**: BOT-552-MJM

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1		1		1					
CO 2	3		1						
CO 3	3								
CO 4	3								
CO 5				2				1	
CO 6					1				1
CO 7						1	1		

Justification for the mapping

PO1: Disciplinary Knowledge

CO2.Understand physiological processes involved in growth and development of plantsCO3. Understanding of transpiration, photosynthesis and respiration, nutrient uptake.
CO4. Recognize response in stress like drought, salinity and pathogens.

PO2: Critical Thinking and Problem Solving

CO1. Development of expertise in plant physiology and biochemistry.

PO 3: Social competence

CO2.Understand physiological processes involved in growth and development of plants.

PO 4: Research-related skills and Scientific temper

CO1. Development of expertise in plant physiology and biochemistry.
CO5. Explore the synthesis and functions of secondary metabolites in plants.

PO5: Trans-disciplinary Knowledge

CO6. Study the intricate biochemical pathways in plants.

PO6: Personal and Professional Competence

CO7. Examine the role of plant hormones and growth regulators.

PO 7: Effective Citizenship and Ethics

CO7. Examine the role of plant hormones and growth regulators.

PO 8: Environment and Sustainability

CO5. Explore the synthesis and functions of secondary metabolites in plants.

PO 9: Self-directed and Life-long Learning

CO6. Study the intricate biochemical pathways in plants.

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem II) **Subject**: Botany

Course: Botany Laboratory - I **Course Code**: BOT-553-MJM

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3	3	1						1
CO 2	3								
CO 3	3								
CO 4		3		2			1		
CO 5					1	1		1	1
CO 6		3							
CO 7	3								

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Students will be able to accurately identify and classify pteridophyte specimens.CO2. Students will comprehend the reproductive mechanisms of gymnosperms.

CO3. Students will gain a deeper understanding of the evolutionary relationships andadaptations.

CO7. They will know the evolution of land plants and their significance in Earth's history.

PO2: Critical Thinking and Problem Solving

CO1. Students will be able to accurately identify and classify pteridophyte specimens.

CO4. They will recognize fossil specimen importance in reconstructing ancient plantcommunities.

CO6. Student will describe and compare the life cycles and highlighting differences andsimilarities.

PO 3: Social competence

CO1. Students will be able to accurately identify and classify pteridophyte specimens.

PO 4: Research-related skills and Scientific temper

CO4. They will recognize fossil specimen importance in reconstructing ancient plantcommunities.

PO5: Trans-disciplinary Knowledge

CO5. They will able to infer information about past environments and ecosystems.

PO6: Personal and Professional Competence

CO5. They will able to infer information about past environments and ecosystems.

PO 7: Effective Citizenship and Ethics

CO4. They will recognize fossil specimen importance in reconstructing ancient plantcommunities.

PO 8: Environment and Sustainability

CO5. They will able to infer information about past environments and ecosystems.

PO 9: Self-directed and Life-long Learning

CO1. Students will be able to accurately identify and classify pteridophyte specimens.
CO5. They will able to infer information about past environments and ecosystems.

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem II) **Subject**: Botany

Course: Botany Laboratory - II **Course Code**: BOT-554-MJM

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3			3					
CO 2	3	1	1			1		1	
CO 3	3					1			
CO 4				1					1
CO 5				3					
CO 6	3								
CO 7			1	2					

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Expertise in conducting a variety of plant physiology and biochemistry experiments.

CO2. A deep understanding of plant response to abiotic and biotic factors.

CO3. Expertise in using and maintaining laborator equipments.

CO6. Students get knowledge about various biomolecules present in plants.

PO2: Critical Thinking and Problem Solving

CO2. A deep understanding of plant response to abiotic and biotic factors.

PO 3: Social competence

CO2. A deep understanding of plant response to abiotic and biotic factors.

CO7. Students trained in physiological and biochemical techniques

PO 4: Research-related skills and Scientific temper

CO1. Expertise in conducting a variety of plant physiology and biochemistry experiments.

CO4. Students will able to do research, careers in life sciences.

CO5. Students will get the ability to design and execute controlled experiments.

CO7. Students trained in physiological and biochemical techniques

PO6: Personal and Professional Competence

CO2. A deep understanding of plant response to abiotic and biotic factors.
CO3. Expertise in using and maintaining laborator equipments.

PO 8: Environment and Sustainability

CO2. A deep understanding of plant response to abiotic and biotic factors
.

PO 9: Self-directed and Life-long Learning

CO4. Students will able to do research, careers in life sciences.

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem II) **Subject**: Botany

Course: Molecular Biology and Genetic Engineering **Course Code**: BOT-561-MJE (A)

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3	2							
CO 2				3		1			
CO 3				3					
CO 4					1		2	2	2
CO 5			1						
CO 6		2		2					
CO 7	1	2		2					

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Students will be able to explain the central dogma of molecular biology.

CO7. They will be able to formulate and address research questions, design experiments, analyze data.

PO2: Critical Thinking and Problem Solving

CO1. Students will be able to explain the central dogma of molecular biology.

CO6. They will able to analyze genetic data, and predict gene functions.

CO7. They will be able to formulate and address research questions, design experiments, analyze data.

PO 3: Social competence

CO5. Students will be able to engage in informed discussions.

PO 4: Research-related skills and Scientific temper

CO2. Students will be able to perform techniques such as PCR, DNA cloning.

CO3. Students will be able to analyze and interpret gene regulation networks.

CO6. They will able to analyze genetic data, and predict gene functions.

CO7. They will be able to formulate and address research questions, design experiments, analyze data.

PO5: Trans-disciplinary Knowledge

CO4. They will apply genetic engineering principles to areas such as the production of recombinant proteins, gene therapy.

PO6: Personal and Professional Competence

CO2. Students will be able to perform techniques such as PCR, DNA cloning.

PO 7: Effective Citizenship and Ethics

CO4. They will apply genetic engineering principles to areas such as the production of recombinant proteins, gene therapy.

PO 8: Environment and Sustainability

CO4. They will apply genetic engineering principles to areas such as the production of recombinant proteins, gene therapy.

PO 9: Self-directed and Life-long Learning

CO4. They will apply genetic engineering principles to areas such as the production of recombinant proteins, gene therapy.

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem II) **Subject**: Botany

Course: Plant Ecology and Biodiversity **Course Code**: BOT-561-MJE (B)

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1							1	1	
CO 2		2		2					
CO 3	3								
CO 4	3	2		2					
CO 5			1			2			1
CO 6			1			2			1
CO 7			1		1		1	1	1

Justification for the mapping

PO1: Disciplinary Knowledge

CO3. Students will be understood the concepts, types and functions of various ecosystems.

CO4. Identify plant species and communities in various ecosystems.

PO2: Critical Thinking and Problem Solving

CO3. Students will be understood the concepts, types and functions of various ecosystems.

CO4. Identify plant species and communities in various ecosystems.

PO 3: Social competence

CO5. Recognize conservation of biodiversity.

CO6. Recognize and assess human impacts on plant biodiversity and ecosystems.

CO7. Develop strategies to protect and manage plant biodiversity.

PO 4: Research-related skills and Scientific temper

CO2. Students will be able to identify plant vegetative.

CO4. Identify plant species and communities in various ecosystems.

PO5: Trans-disciplinary Knowledge

CO7. Develop strategies to protect and manage plant biodiversity.

PO6: Personal and Professional Competence

CO5. Recognize conservation of biodiversity.
CO6. Recognize and assess human impacts on plant biodiversity and ecosystems.

PO 7: Effective Citizenship and Ethics

CO1. Appreciate the ethical, cross-cultural and historical context of environmental issues.
CO7. Develop strategies to protect and manage plant biodiversity.

PO 8: Environment and Sustainability

CO1. Appreciate the ethical, cross-cultural and historical context of environmental issues.
CO7. Develop strategies to protect and manage plant biodiversity.

PO 9: Self-directed and Life-long Learning

CO5. Recognize conservation of biodiversity.
CO6. Recognize and assess human impacts on plant biodiversity and ecosystems.CO7. Develop strategies to protect and manage plant biodiversity.

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem II) **Subject**: Botany

Course: On Job Training & Field Project **Course Code**: BOT-581-OJT/FP

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1		2		3					
CO 2		2							
CO 3	2								
CO 4	2	1			1				
CO 5			1				1		
CO 6	1								
CO 7									1

Justification for the mapping

PO1: Disciplinary Knowledge

CO3. Review of literature.
CO4. Results and discussion.
CO6. Review of literature.

PO2: Critical Thinking and Problem Solving

CO1. Hands on training and practical skills.
CO2. Writing of review and case studies.
CO4. Results and discussion.

PO 3: Social competence

CO5. Writing of review and case studies.

PO 4: Research-related skills and Scientific temper

CO1. Hands on training and practical skills.

PO5: Trans-disciplinary Knowledge

CO4. Results and discussion.

PO 7: Effective Citizenship and Ethics

CO5. Writing of review and case studies.

PO 9: Self-directed and Life-long Learning

CO7. Results and discussion.